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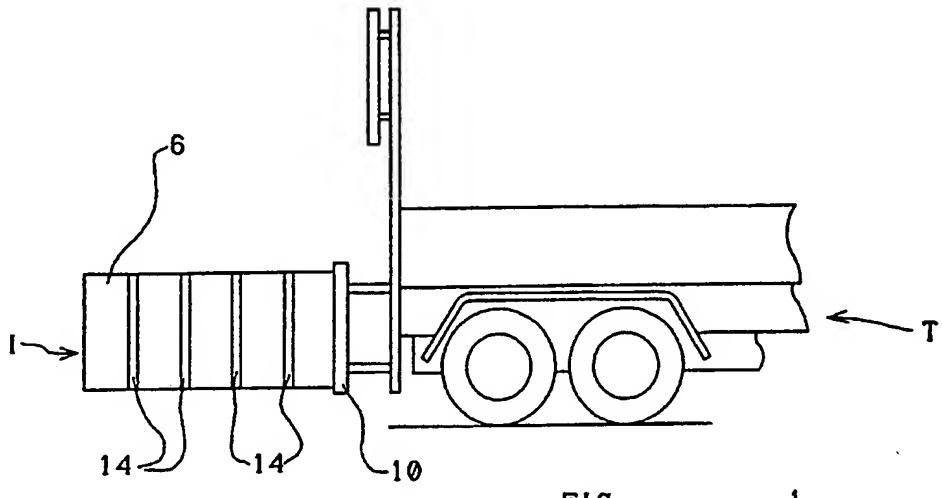
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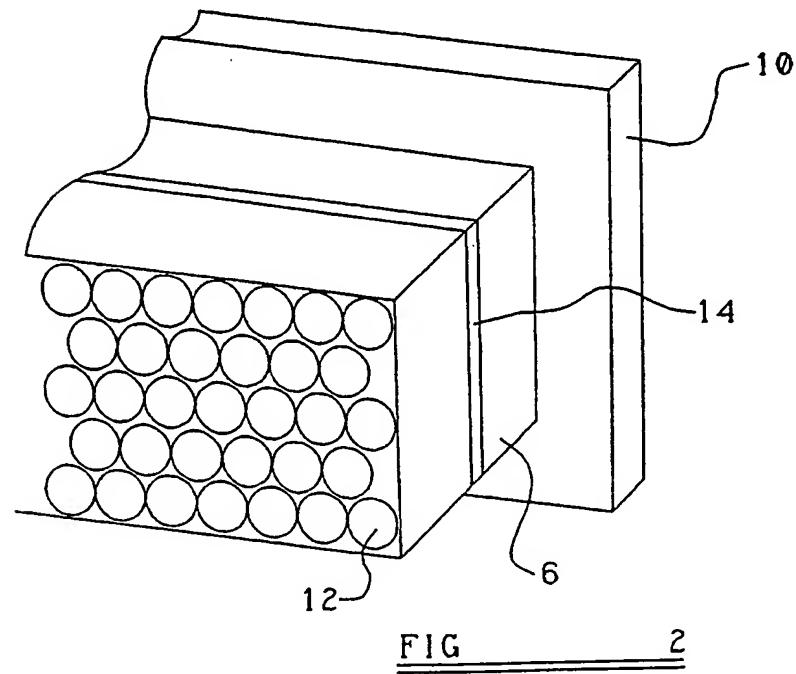
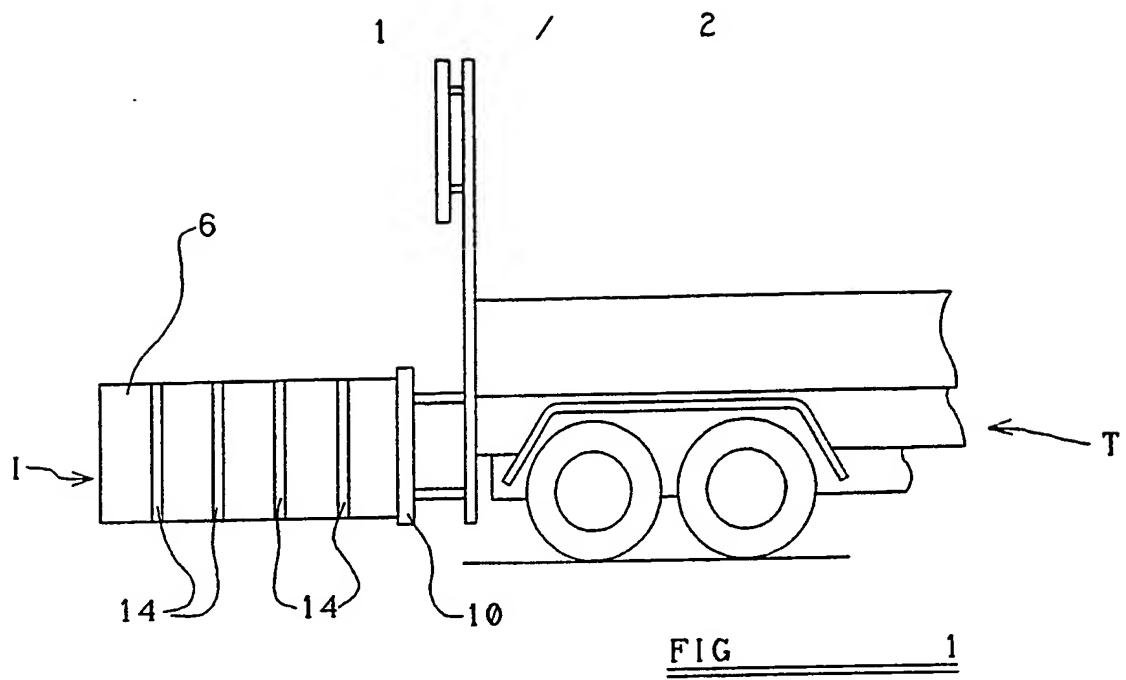
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## (54) Vehicle crash cushion

(57) A crash cushion 1 for mounting on the rear of a vehicle T comprises a plurality of aluminium drinks cans (12, Figure 2) within a housing 6, reinforcing bands 14 being provided to restrain the housing against outward movement in the event of an impact. The cans may be arranged in a variety of ways; with their axes parallel to the direction of travel, transverse to the direction of travel, a combination of these, or randomly. Cans of different sizes may be used, and they may be crushed before use in the cushion. The cans may be enclosed by polythene shrink wrapping, or in foam. In another arrangement (Figure 3), clamping plates (20) are provided on the side walls of the housing to reduce the tendency of the housing to burst on impact.



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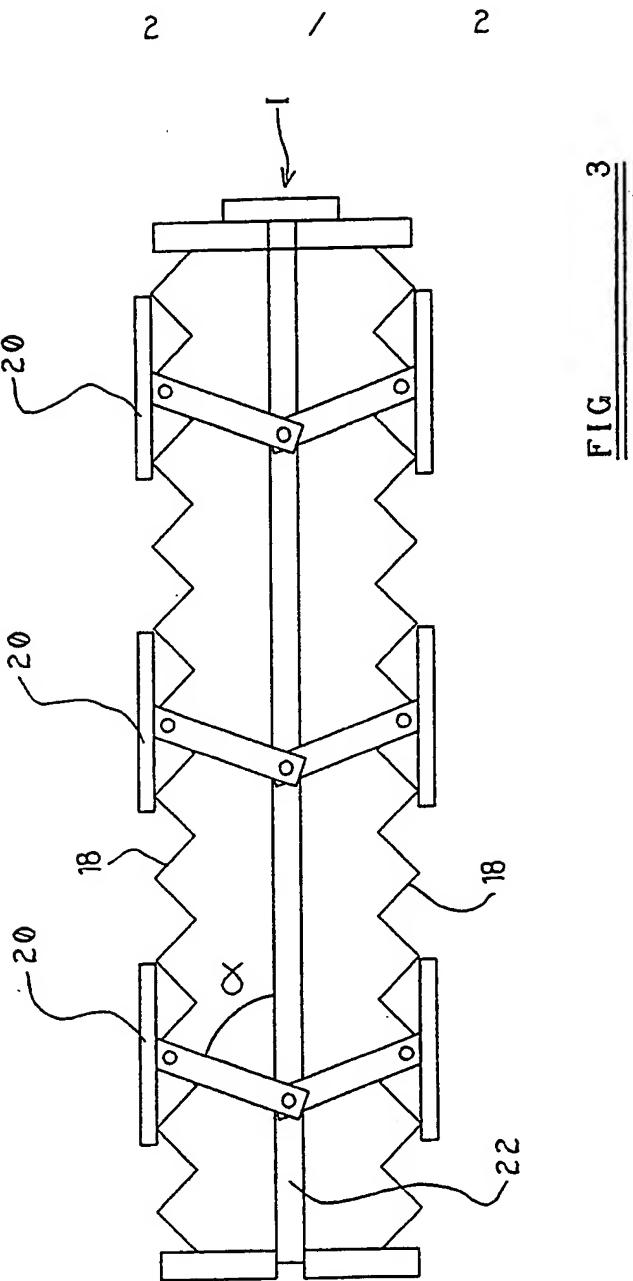


FIG 3

PATENTS ACT 1977

Title: Improvements relating to crash cushions

Description of Invention

Vehicle mounted crash cushions have been developed specifically to protect highway works crews and their equipment and to protect highway users and their vehicles. The specific problem that vehicle mounted crash cushions (hereinafter referred to as TMCC for convenience) have been built to help solve centers on the slow moving/parked vehicles used to shadow machine highway maintenance activities. The problem is simply that inattentive motorists sometimes crash into the back of these vehicles, even though the presence of vehicles and their purpose have been made apparent through the careful use of warning signs, flashing lights, road cones and the like.

The conventional TMCC comprises a housing supported in a cantilevered manner from the back of a vehicle, the housing being filled with aluminium honeycomb material to absorb crash impact energy, the honeycomb providing the useful combination of the desired qualities of being lightweight, having excellent structural and energy absorption properties, and having a corrosion resistant finish.

A conventional TMCC is designed to absorb the energy of a rear impact from a conventional car travelling at 45 mph (70kph).

However aluminium honeycomb is expensive, and it is one of the various objects of this invention to provide a crash cushion which is less expensive to produce, and which can be repaired or replaced more expeditiously.

Further whilst the invention has been devised primarily for mounting on vehicles, in the provision of a TMCC, it is to be appreciated that the invention may be utilised in other situations where the need to provide an inexpensive crash cushion exists, including static situations.

According to this invention there is provided a crash cushion comprising a housing and, located within the housing, a plurality of crushable hollow cylindrical members.

Preferably the members are substantially closed at at least one end, and are preferably substantially closed at both ends.

The cylindrical members may be arranged randomly within the housing, but preferably are arranged with axes extending in a pattern, for example with the longitudinal axes of a first group of members extending parallel to one axis and the longitudinal axes of a second group of members extending parallel to another axis. Thus, the first group may be arranged with axes extending in the longitudinal direction i.e. the theoretical impact direction whilst the second group is arranged with axes extending transverse, preferably at right angles to said longitudinal direction.

Alternatively said members may be arranged with their axes parallel, either longitudinally or transverse.

Preferably the cylindrical members have height between 5 to 15cm, preferably within the range 7.5 to 12cm, and preferably have a diameter within the range 4 to 10cm, preferably within the range 5 to 7.5cm.

If desired members of more than one size may be utilised.

Preferably the members are thin walled, advantageously having a thickness within the range 0.05 mm and 0.2 mm, preferably about 0.1 mm. Conveniently the members are aluminum, but other convenient metal may be utilised.

Most conveniently the members are afforded by "cans" in which drinks are vended, e.g. colas, lemonades, lagers and the like and are preferably afforded by such members after they have been utilised and disposed.

Groups or layers of the cylindrical members may be enclosed, e.g. by shrink-wrapping in polythene, or may be encapsulated in foam, e.g. polyurethane.

Alternatively barrier means, such as struts, may be utilised to retain the cylindrical members in position.

According to this invention there is also provided a crash cushion comprising a housing and, located within the housing, a plurality of crushable members afforded by empty drinks cans.

Preferably the drinks cans are substantially undistorted (uncrushed) but it has been found that crushed cans provide a significant degree of energy absorbtion, and it is within the scope of this invention to provide a crash cushion comprising a housing filled with empty drinks cans, crushed or otherwise.

Most conveniently where crushed cans are utilised, they are disposed within the housing randomly.

Preferably the housing comprises walls of crushable material, e.g. thin aluminum or steel sheet, and preferably means is provided to restrain forces acting at right angles to the longitudinal axis, to restrain cylindrical members against bursting through the housing. Such restraint may be provided by circumferential bands, or may be provided to clamp the housing against transverse outward forces by a means which is operative to increase the clamping force in response to impact forces.

Preferably the housing comprises at one end mounting means (e.g. a mounting plate) to enable it to be mounted in position conveniently, and demounted for replacement in the event of having been damaged.

According to this invention there is also provided a vehicle having mounted rearwardly thereof a crash cushion as set out in the last preceding paragraphs.

Preferably the crash cushion is mounted on a vehicle in a cantilevered manner.

There will now be given a detailed description, to be read with reference to the accompanying drawings, of a crash cushion which has been selected for the purposes of illustrating the invention by way of example.

In the accompanying drawings:

FIGURE 1 is a schematic view showing the crash cushion, which is a preferred embodiment of this invention, mounted rearwardly on a vehicle;

FIGURE 2 is an enlarged perspective view of the crash cushion, part of the housing thereof having been broken away for clarity; and

FIGURE 3 is a schematic view showing a modified version of the preferred embodiment.

The crash cushion which is the preferred embodiment of this invention is for mounting on the rear of a vehicle T in a cantilevered manner, and comprising a generally rectangular housing 6, conveniently made of aluminium sheet, secured to a mounting plate 10 by which the crash cushion may be secured to the rear of the vehicle in a cantilevered manner, as shown in Figure 1.

Mounted within the housing are a plurality of drinks cans 12, arranged in the preferred embodiment with their longitudinal axes extending parallel to the theoretical impact axis I, the cans being empty, being substantially uncrushed, and apart from the ring pull opening at one end, being closed at their opposite ends.

Reinforcing means 14 is provided, in the form of bands 14 extending circumferentially around the housing, to restrain the housing against bursting forces in the event of impact.

It has been found that a crash cushion as described above provides a significant degree of energy absorption, and protection, for highway workers and travellers, at significantly lower cost than was previously possible, while simultaneously providing the use of a previously waste material.

Whilst in the preferred embodiment the cylindrical members 12 are shown with their axes extending parallel to one another and to the axis I, if desired other arrangements may be utilised, including the location of the members 12 with their axes extending at right angles to the axis I, or a combination thereof. Indeed, it is within the scope of this invention for the members 12 to be arranged within the housing 6 randomly.

Additionally whilst the members 12 are shown as being substantially undistorted empty drinks cans, it is within the scope of this invention for crushed cans to be utilised, wholly or in part, as energy absorbent elements.

In the modification shown in Figure 3, the side walls 18 of the housing are of corrugated form, and clamping devices 20 are utilised, connected to a longitudinal extending thrust arm 22 which moves forwardly, in the direction I on impact, to provide clamping forces against the side walls of the housing to reduce tendency of bursting to occur.

It will be appreciated that the clamping pressure of the clamping devices 20 may be selected by an appropriate selection of the toggle angle and if desired one or more internal partition members may be provided in the housing 6, to restrain undesired movement of the cylindrical members 12, either prior to or during impact, for example by the use of internal partitions or struts. Alternatively or in addition the cans, or groups thereof, may be shrink-wrapped or banded together. Alternatively the assembly of cans may be encapsulated in a foam plastics material, such as polyurethane.

Additionally whilst the preferred embodiment shows the use of members 12 of a single size, if desired two or more different sizes of empty drinks cans may be utilised. Indeed, by utilising two sizes of cylinder, having diameters  $D_1$  and  $D_2$ , where  $2D_1^2 = (D_1 + D_2)^2$ , a higher crushing density may be achieved.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

## CLAIMS

1. A crash cushion comprising a housing and, located within the housing, a plurality of crushable hollow cylindrical members.
2. A crash cushion according to Claim 1 wherein the hollow cylindrical members are closed at a least one end.
3. A crash cushion according to one of Claims 1 and 2 wherein the cylindrical members are substantially closed at both ends.
4. A crash cushion according to any one of the preceding claims wherein the cylindrical members are arranged randomly within the housing.
5. A crash cushion according to any one of Claims 1, 2 and 3 wherein the cylindrical members are arranged with axes extending in a pattern.
6. A crash cushion according to Claim 5 wherein the pattern is one in which the longitudinal axes of a first group of members extend parallel to one axis, and the longitudinal axes of a second group of members extends parallel to another axis.
7. A crash cushion according to Claim 6 wherein the first group is arranged with axes extending in the longitudinal direction, and the second group are arranged with axes extending transversely to the longitudinal direction.
8. A cash cushion according to Claim 7 wherein the members are arranged with their axes parallel.

9. A crash cushion according to any one of the preceding claims wherein the cylindrical members have a height of between 5 to 15cm, preferably within the range 7.5 to 12cm.

10. A crash cushion according to any one of the preceding claims wherein the cylindrical members have a diameter within the range 4 to 10cm, preferably within the range 5 to 7.5cm.

11. A crash cushion according to any one of the preceding claims wherein cylindrical members of more than one size are utilised.

12. A crash cushion according to any one of the preceding claims wherein the members are thin walled, preferably having a thickness within the range 0.05mm to 0.2mm, preferably about 0.1mm.

13. A crash cushion according to any one of the preceding claims wherein the members are of aluminium.

14. A crash cushion according to any one of the preceding claims wherein the members are afforded by "cans" in which drinks are vended.

15. A crash cushion according to any one of the preceding claims wherein groups or layers of the cylindrical members are enclosed.

16. A crash cushion according to Claim 15 wherein the cylindrical members are enclosed by shrink wrapping in polythene, or in foam.

17. A crash cushion according to any one of Claims 1 to 14 comprising struts to retain the cylindrical members in position.

18. A crash cushion comprising a housing, and, located within the housing, a plurality of crushable members afforded by empty drinks cans.
19. A crash cushion according to Claim 18 wherein the drinks cans are substantially undistorted.
20. A crash cushion according to Claim 18 wherein some at least of the cans are crushed.
21. A crash cushion according to Claim 20 wherein the cans are disposed within the housing randomly.
22. A crash cushion according to any one of Claims 18 to 21 wherein the housing comprises walls of crushable material.
23. A crash cushion according to Claim 22 wherein the walls comprise thin aluminium or steel sheets, means being provided to restrain forces acting at right angles to the longitudinal axis, to restrain cylindrical members against bursting through the housing.
24. A crash cushion according to Claim 23 wherein such restraint is provided by circumferential bands.
25. A crash cushion according to Claim 23 wherein such restraint is provided by a means which is operative to increase the clamping force in response to impact forces.
26. A crash cushion according to any one of the preceding claims comprising at one end a mounting means to enable the crash cushion to be mounted in position conveniently, and demounted for replacement.

27. A vehicle having mounted rearwardly thereof a crash cushion according to any one of the preceding claims.

28. A vehicle according to Claim 27, wherein the crash cushion is mounted on the vehicle in a cantilevered manner.

29. A crash cushion substantially as hereinbefore described as shown in the accompanying drawings.

30. A vehicle having mounted thereon a crash cushion, substantially as hereinbefore described with reference to the accompanying drawings.

31. Any novel feature or novel combination of features hereinbefore described and/or shown in the accompanying drawings.



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Patent  
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Application No: GB 9402141.7  
Claims searched: 1-30

Examiner: Mrs Pat Everett  
Date of search: 26 April 1995

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): B7B (BSES,BSEB) F2S (SCM)

Int Cl (Ed.6): B60R 19/00,18,54 F16F 7/12 E01F 15/00

Other: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB1492752A SEARLE etc (Note figures 2,3,5)	1,5-8,11
X	US5123775A BRYANT (Figures 4,5 and column 4 lines 46-53)	1-3,5,8-10,12-15,18,19,22,23 26,27
X	US4118014A FROSCH (Figure 3)	1-3,5,8-10,12-15,17-19,22,23
X	US4008915A WALKER (Note cylinders 23,figure 3)	1,5,8,24,26,27

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.